Drawings - Sheet 1 of 19

Invention: WIRELESS VIDEO TRANSMISSION SYSTEM

Applicant: Petrus J.L. van Beek

Filed:

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Attorney:

Kevin L. Russell, Reg. No. 38,292

Docket No.

7146.0168

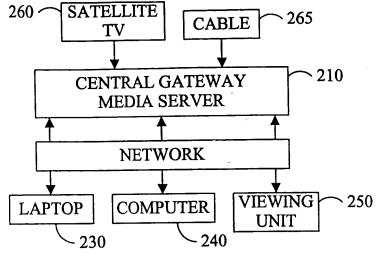


FIG. 1

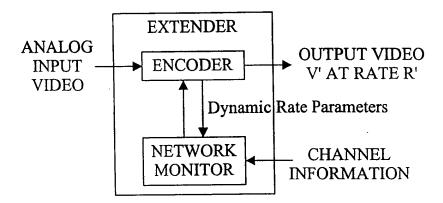


FIG. 2

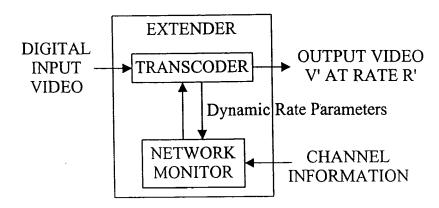


FIG. 3

Invention: WIRELESS VIDEO TRANSMISSION SYSTEM

Applicant: Petrus J.L. van Beek

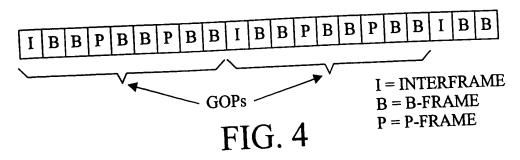
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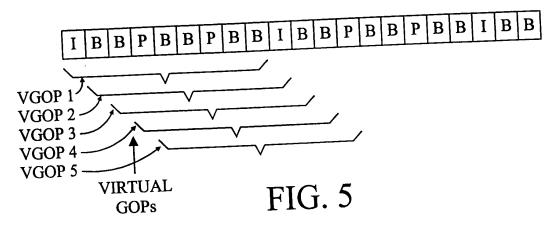
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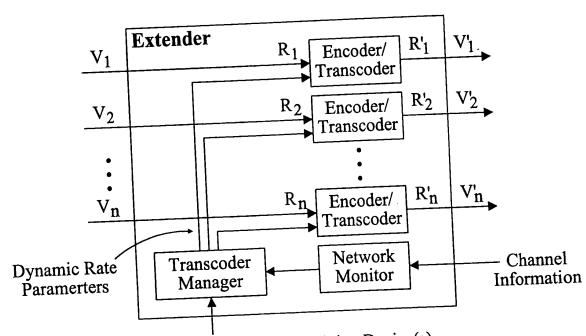
Attorney:

Kevin L. Russell, Reg. No. 38,292

(503) 227-5631 Telephone:







Information about Receiving Device(s) Information about Video Sources $(V_1\,,V_2\,,...\,,V_n)$ Information about User Preferences

FIG. 6

Drawings - Sheet 3 of 19

Invention: WIRELESS VIDEO TRANSMISSION SYSTEM

Applicant: Petrus J.L. van Beek

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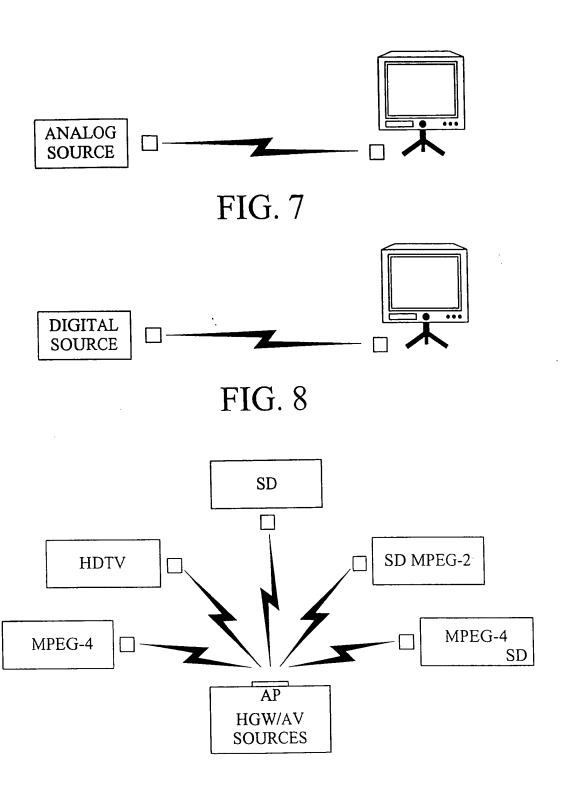


FIG. 9

Drawings - Sheet 4 of 19

Invention: WIRELESS VIDEO TRANSMISSION SYSTEM

Applicant: Petrus J.L. van Beek

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Attorney: Kevin L. Russell, Reg. No. 38,292

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(MPEG-2 TM5):

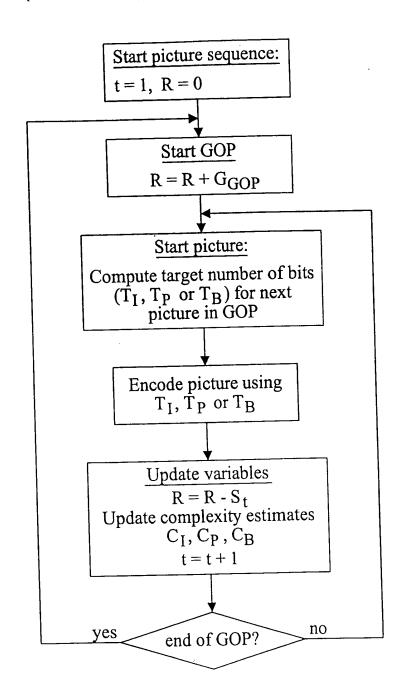


FIG. 10

Drawings - Sheet 5 of 19

Invention: WIRELESS VIDEO TRANSMISSION SYSTEM

Applicant: Petrus J.L. van Beek

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Telephone: (503) 227-5631

Dynamic rate adaptation with Virtual GOPs (VGOPs)

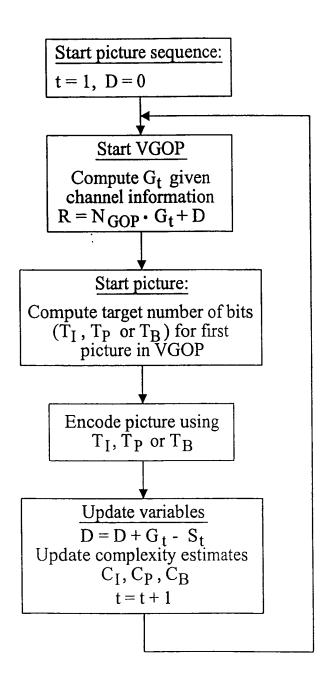


FIG. 11

Drawings - Sheet 6 of 19 Invention: WIRELESS VIDEO TRANSMISSION SYSTEM Applicant: Petrus J.L. van Beek

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No or slowly varying channel conditions - super-GOP-by-GOP bit allocation (MPEG-2)

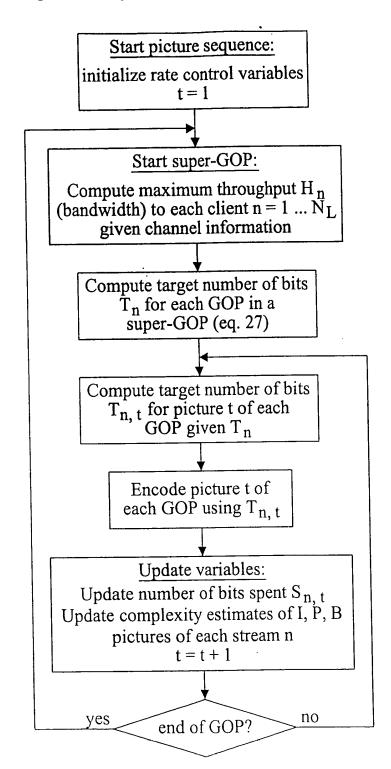


FIG. 12

Drawings - Sheet 7 of 19

Invention: WIRELESS VIDEO TRANSMISSION SYSTEM

Applicant: Petrus J.L. van Beek d: Concurrently herewith Attorney: K

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Dynamic channel conditions - virtual-super-GOP-by-virtual-super-GOP bit allocation

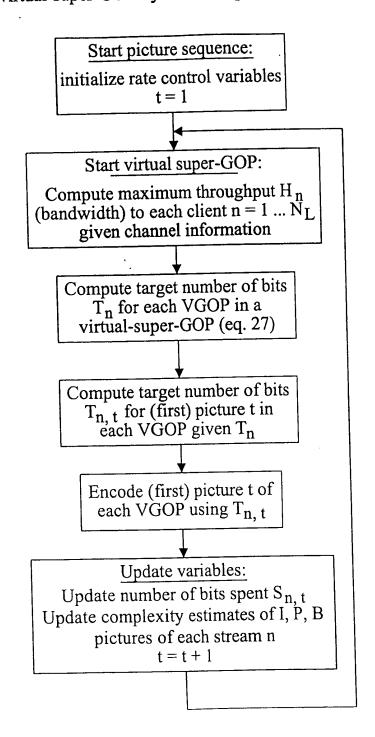


FIG. 13

Drawings - Sheet 8 of 19

Invention: WIRELESS VIDEO TRANSMISSION SYSTEM

Applicant: Petrus J.L. van Beek

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Dynamic channel conditions super-frame-by-super-frame bit allocation (no GOPs)

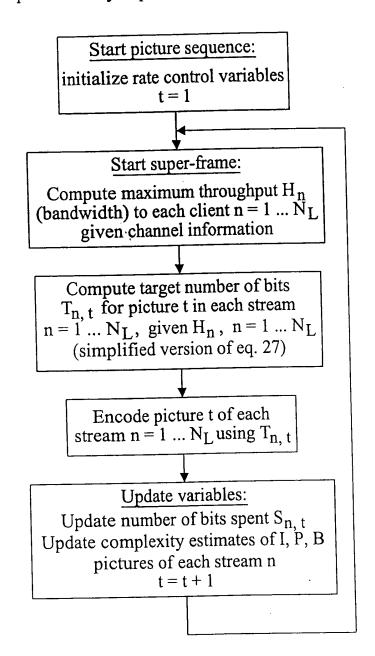


FIG. 14

Drawings - Sheet 9 of 19

Invention: WIRELESS VIDEO TRANSMISSION SYSTEM

Applicant: Petrus J.L. van Beek

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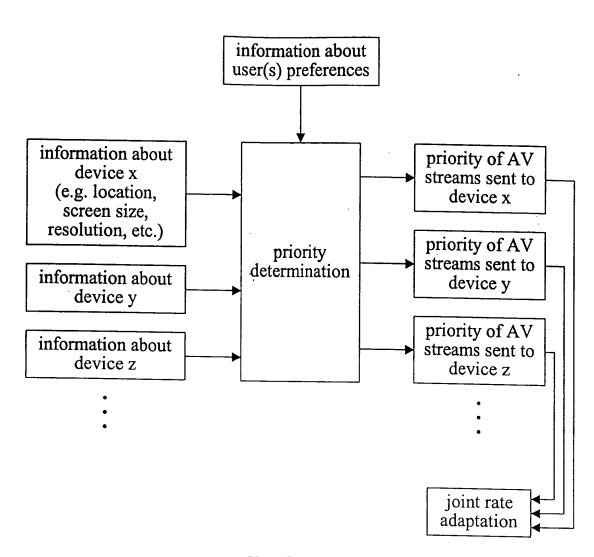


FIG. 15

Drawings - Sheet 10 of 19

Invention: WIRELESS VIDEO TRANSMISSION SYSTEM

Applicant: Petrus J.L. van Beek

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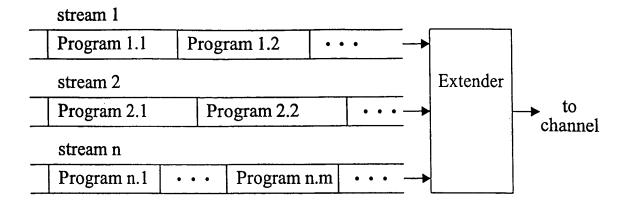
Attorney:

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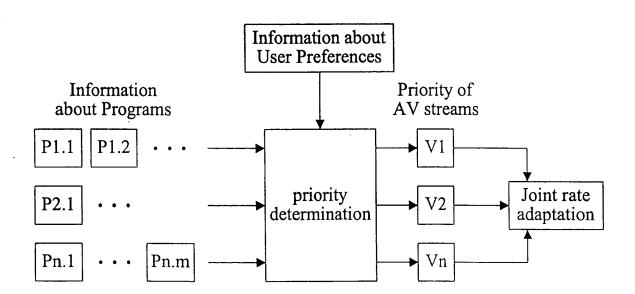


FIG. 16

Drawings - Sheet 11 of 19

Invention: WIRELESS VIDEO TRANSMISSION SYSTEM

Applicant: Petrus J.L. van Beek

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FIG. 17

Drawings - Sheet 12 of 19

Invention: WIRELESS VIDEO TRANSMISSION SYSTEM

Applicant: Petrus J.L. van Beek

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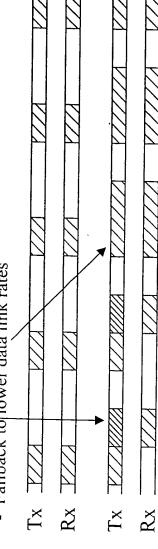
Kevin L. Russell, Reg. No. 38,292

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· Channel condition deterioration will cause:

Idealized model of MAC (using 802.11 DCF)

Re-transmissions of lost packets Fallback to lower data link rates



Drawings - Sheet 13 of 19 Invention: WIRELESS VIDEO TRANSMISSION SYSTEM

Petrus J.L. van Beek Applicant:

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La Maria

A model-based approach at the video layer (1 stream case)

- Measurements by application/video layer (outside MAC) - Variation in packet arrival times indicate changes of data link

rate and retransmissions

packet submissions

· Measure packet transmission and arrival times:

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FIG. 19

· Packet burst approach

packet arrivals

RX

 $\stackrel{\prec}{\vdash}$

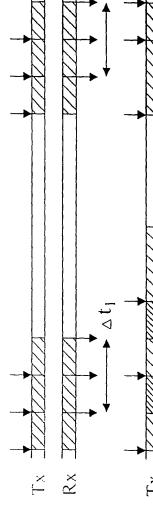


FIG. 20

 $\frac{8}{2}$

 $\stackrel{\prec}{\sim}$

Drawings - Sheet 14 of 19

Invention: WIRELESS VIDEO TRANSMISSION SYSTEM

Applicant: Petrus J.L. van Beek

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y: Kevin L. Russell, Reg. No. 38,292

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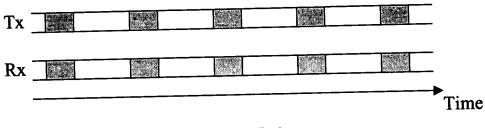


FIG. 21

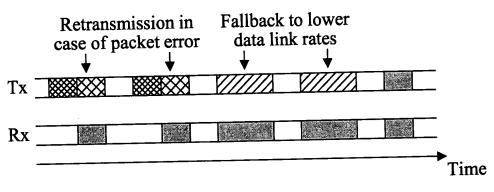


FIG. 22

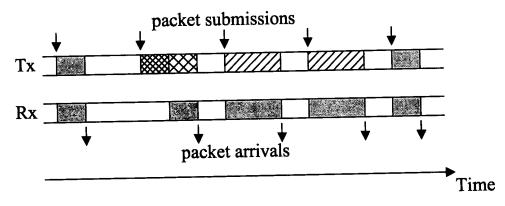


FIG. 23

Drawings - Sheet 15 of 19

Invention: WIRELESS VIDEO TRANSMISSION SYSTEM

Applicant: Petrus J.L. van Beek

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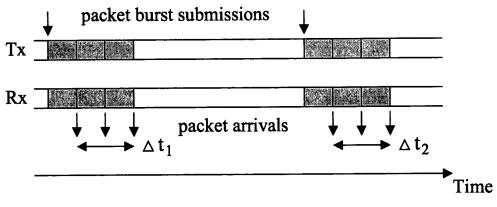


FIG. 24

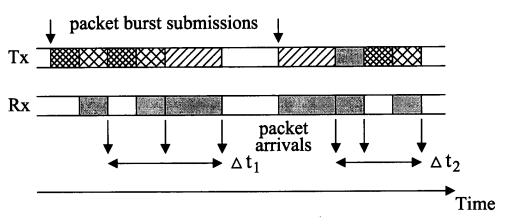
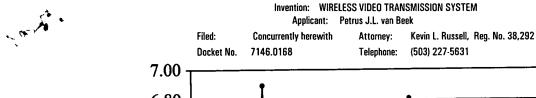
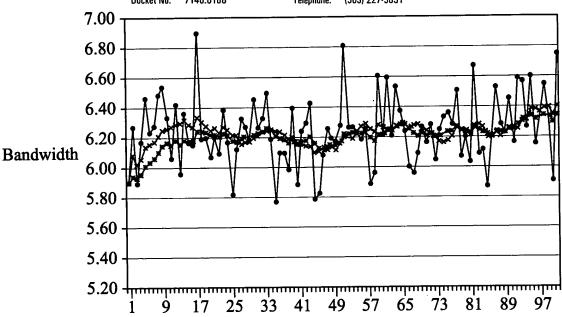


FIG. 25

Drawings - Sheet 16 of 19

Invention: WIRELESS VIDEO TRANSMISSION SYSTEM





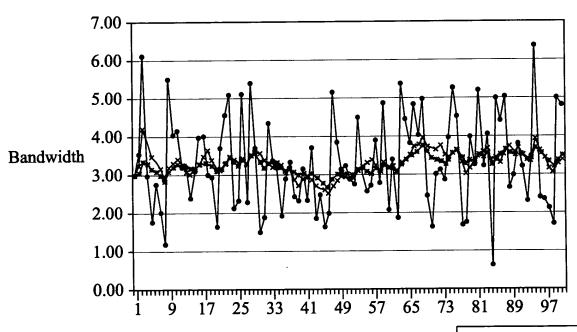
Measurements of maximum throughput/bandwidth using the packet burst method in ideal conditions.

- Bandwidth

→ 10-point average

-- IIR(0.1)

FIG. 26



Measurements of maximum throughput/bandwidth using the packet burst method in non-ideal conditions

- Bandwidth
- → 10-point average
- $\leftarrow IIR(0.1)$

FIG. 27

Drawings - Sheet 17 of 19

Invention: WIRELESS VIDEO TRANSMISSION SYSTEM

Applicant: Petrus J.L. van Beek

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Attorney: Kevin L. Russell, Reg. No. 38,292

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Receive packet burst j

Burst j consists of N_i packets of size P_i

Detect packet losses in packet burst j

Measure the time of arrival of packets of burst j

Compute bandwidth sample for burst j

Compute the interval $\triangle t_i$ between arrival time of first and last packet of burst j

Compute bandwidth sample T_i for burst j

Compute final bandwidth estimate for burst j

Process the sequence of bandwidth samples T_m , $j - M_1 \le m \le j$, optionally utilizing previous final estimates T_m^* , $j - M_2 \le m \le j - 1$, to compute final bandwidth estimate T_j^* for burst j

Transmit feedback to sender

According to a pre-determined schedule or criterion, decide whether to transmit feedback information to the sender

If it is a scheduled time or the criterion is satisfied, transmit feedback information to the sender

FIG. 28A

Drawings - Sheet 18 of 19

Invention: WIRELESS VIDEO TRANSMISSION SYSTEM

Applicant: Petrus J.L. van Beek

Docket No. 7146.0168

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Receive packet burst j

Burst j consists of N_j packets of size P_j

Detect packet losses in packet burst j

Measure the time of arrival of packets of burst j

Compute time interval for burst j

Compute the interval Δt_j between arrival time of first and last packet of burst j

Compute final bandwidth estimate for burst j

Process the sequence of time interval samples Δt_m , $j - M_1 \le m \le j$, optionally utilizing previous final estimates $\triangle t_m^*$, $j - M_2 \le m \le j - 1$, to compute a final estimate Δt_i^* of the time interval for burst j

Compute final bandwidth sample T_j^* for burst j using $T_j^* = \frac{P_j \cdot (N_j - 1)}{\Delta t_i^*}$

Transmit feedback to sender

According to a pre-determined schedule or criterion, decide whether to transmit feedback information to the sender

If it is a scheduled time or the criterion is satisfied, transmit feedback information to the sender

FIG. 28B

Drawings - Sheet 19 of 19

Invention: WIRELESS VIDEO TRANSMISSION SYSTEM

Applicant: Petrus J.L. van Beek

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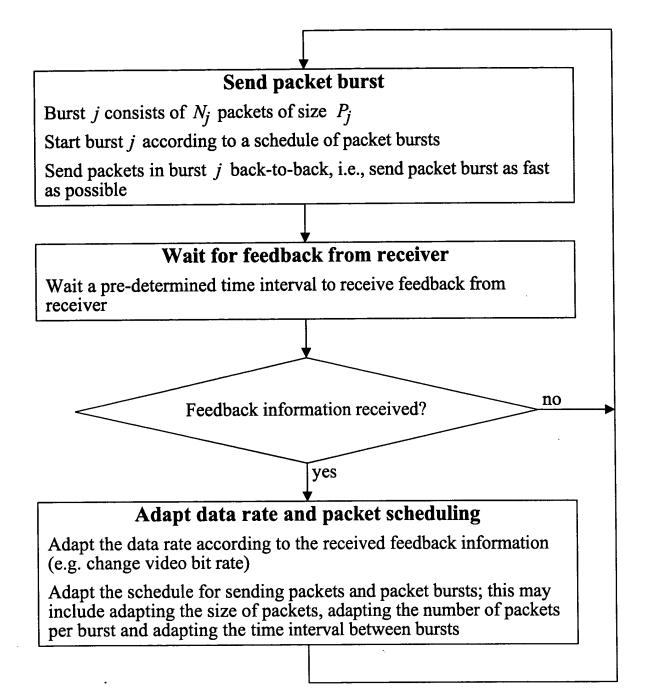


FIG. 29